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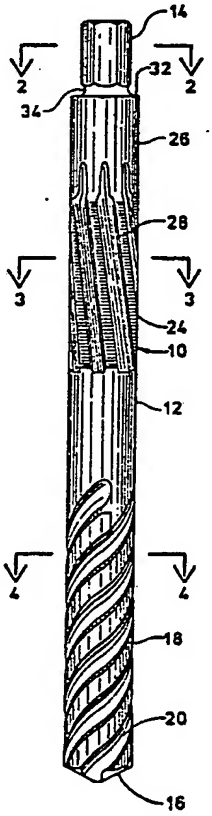
(54) Title: DRILL BIT

(57) Abstract

A drill bit is in the form of an elongated one-piece rod (12) disposed of tool steel. One end portion (14) has a hexagonal cross-section. The other end portion (16) is pointed and shaped along its length to define a twist drill (18) of uniform external diameter and having a spiral groove (20) with one margin (22) defining a cutting edge facing in the direction of rotation. An intermediate portion of the rod, between the end portions, is formed along its length to define a reamer (24) or smoother. Different embodiments include, in the hex portion, circumferential shear grooves (34) and detenting grooves (68).



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DRILL BIT
SPECIFICATION

Certain concepts discussed herein also are disclosed in my co-pending application Serial No. 271,394, filed June 8, 1981, which otherwise is directed to various arrangements for coupling a drill bit to a chuck.

The present invention relates to drill bits and related tools. More particularly, it pertains to variations in bits which accommodate drilling or shaping into a variety of different materials and which may be secured or coupled firmly to the chuck of a power tool.

Bits for mounting to drills and other boring apparatus have taken a wide variety of forms. A wood auger, as shown in 3,136,347-Linquist, has a screw tip followed by cutting edges beyond which a spiral ridge serves as an auger for cut chips of wood. In that bit, the upper end of the shank has an enlarged square collar beyond which is a hex-shaped end portion. Similar wood drills have had either round or square coupling portions.

Twist drills more commonly have a uniform diameter like the one shown in 3,880,546-Segal. They typically have a round coupling configuration, although some have included a flat side to enable a better grasp by certain types of chucks.

In some cases, a reamer has been combined with a drill, the reamer function serving to dress and/or shape the hole initially formed in accordance with the

drilling function. Typical examples are U. S. Patents 1,355,065-Simpson, 2,389,909-Hofbauer and 3,667,857-Shaner et al. In one case, a twist drill is removably attached to a following reamer as shown in 2,369,120-Ferries.

One problem in most of the foregoing combined twist drills and reamers is that the manufacturing operations necessary to form the different cutting and shaping surfaces are exceedingly complex and, thus, costly. Any combination which is composed of a plurality of parts clearly is less desirable from at least the standpoint of cost. In addition, some of the prior drill bits are either more expensive to form or are less flexible as to mode of coupling to a drill because of complexity of shape of the coupling portion.

Another problem in the use of twist drills in conjunction with hand-held power tools is the danger to the operator when the rotating drill bit comes to a sudden stop (as when, in the case of boring wood, one encounters an unseen knot or as in the case of high speed drilling in hard metal). The reaction that sets in causes the driving motor assembly to spin suddenly backwards, putting a strong force on the hand or wrist of the operator. Persons have been known to receive a broken, or smashed hand, wrist or arm as a result.

It is, accordingly, a general object of the present invention to provide new and improved drill bits which overcome one or more of the aforenoted deficiencies.

Another object of the present invention is to provide new and improved drill bits which are readily fabricated with machinery of a conventional kind used for the manufacture of other types of drill bits or for other purposes.

A further object of the present invention is to provide new and improved drill bits which may be modified to any of several different forms each of which has features which accommodate particular characteristics of various materials being drilled.

In accordance with one feature of the present invention, a drill bit includes an elongated one-piece rod composed of tool steel. One end portion of the rod has a hexagonal cross-section. Its other end portion is pointed and is shaped along its length to define a twist drill of uniform external diameter and having a spiral groove with one margin defining a cutting edge facing the direction of rotation. An intermediate portion of the rod is formed along its length to follow the other end portion into a hole and is shaped to smooth the wall of the hole behind that one end portion.

Another feature of the present invention is the provisions of a fail safe shear groove cut into the box shank of the drill attachment (bit, reamer or other tool). That groove is designed to allow the shank to separate from the main stem of the tool, thus preventing injury to the operator. This feature also allows the drill attachment to be used with screw guns or automatic chucks.

The features of the present invention which are believed to be patentable are set forth with particularity in the appended claims. The organization and manner of operation of the invention, together with further objects and advantages thereof, may best be understood with reference to the following description taken in connection with the accompanying drawings, in the several figures of which like reference numerals identify like elements, and in which:

Figure 1 is a side elevational view of one embodiment of a drill bit;

Figures 2, 3 and 4 individually are cross-sectional views taken respectively along lines 2-2, 3-3 and 4-4 in Figure 1;

Figure 5 is a side elevational view of another embodiment;

Figure 6 is a cross-sectional view taken along the line 6-6 in Figure 5;

Figure 7 is a side elevational view of a further embodiment; and

Figure 8 is a side elevational view of still another embodiment.

As shown in Figure 1, a twist drill 10 is formed from an elongated one-piece rod 12 composed of tool steel. Its upper end portion 14 has a hexagonal cross-section. Its lower end portion has a pointed free end 16 from which it is shaped along its length to define a twist drill 18. Twist drill 18 is of uniform external diameter and has a spiral groove 20 with one margin 22 that defines a cutting edge facing in a direction of rotation.

An intermediate portion of rod 12, between upper and lower end portion 14 and 16, is formed along its length to define a reamer 24. Reamer 24 is joined to upper portion 14 by a smooth portion 26 and, in this case, includes slanted grooves 28 each with one margin 30 that defines a shaving edge. From the juncture 32 of upper end portion 14, all of the way to free end 16, the external diameter of rod 12 is continuous and uniform.

Upper end portion 14 is of hexgonal cross section in all versions to be described. The ordinary twist drill in common use has a round upper end or coupling portion which continues into a spiral groove throughout the remainder of its length to its pointed end. If of a sufficiently hard tool steel and properly sharpened, it will form a reasonably clean hole in very hard metals. However, the hole form tends to be less smooth when drilled in many other materials such as soft metals, a variety of plastics and fiberous bodies. The walls of the hole may be left with burrs or scores. When a deep hole is needed, a soft plastic or the like tends to clog the grooves of a twist drill. The round upper end

sufficiently tight in the chuck of the drill to avoid twisting of the bit within the chuck when an especially hard region is reached during drilling or even by reason of a loosening of the chuck through vibration after a continued period of use. Since it is common to stamp the drill size into the side of that upper end portion, it is commonplace to see that identification erased by such twisting.

The drill bit of Figure 1 avoids these problems in several different respects. Twist drill portion 18 need not be very long in itself, regardless of the overall length needed for the bit. Thus, the tendency of soft, cohesive materials to stick within the auger formed by groove 20 is reduced. Reamer 24 can then have a groove 28 which is larger, so as better to serve as an auger of the cut particles out of the hole. At the same time, the cutting edge of margin 30 of groove 28 serves to dress the hole. Smooth portion 26 then may serve, in the case of drilling into softer materials, to finally smooth the finish of the hole, removing any imperfections left by reamer 24.

The function of portion 26 is more like a honing operation. With harder materials, the surface of smooth portion 26 might be inlaid with diamond dust or the like for achieving that function. Being of uniform diameter entirely to juncture 32, the entire drill bit is subject to being readily manufactured on the same machine, if desired. Also, the top of the bit always is free to avoid interference with the surface which surrounds the formed hole.

Specifically as shown in Figure 1, the twist of groove 28 is opposite of that of the twist of groove 20. Yet, margins 22 and 30 face in the same direction. That not only allows the reamer portion to auger cut material on out of the hole, but it also allows insertion into the hole of a cutting lubricant when necessary for harder materials.

Cut or stamped into hex portion 14 is a circular shear groove 34 disposed near juncture 32. Groove 34 is defined to enable the body of the drill bit, beyond the chuck, to shear off when the drill bit in any way becomes stuck in the hole. The depth of groove 34 is selected in view of the size of the drill bit to insure that the drill bit shears free before a driving hand-held power tool will spin backwardly an amount sufficient to cause injury to the operator. Groove 34 preferably is continuous but need not be.

In the embodiment of Figure 5, a drill bit 40 again includes an upper end portion 42 of hexagonal cross-section that includes a shear groove 43. Portion 42 is joined at 44 to a smooth-walled section 46 which continues into an upper twist drill portion 48. Portion 48 has a groove 50 with a cutting margin 52. Portion 40 then continues into a reamer portion 54 which includes longitudinally oriented splines 56 separated by grooves 58. Each spline 56 defines a cutting edge that faces in the direction of rotation as defined by margin 52. Continuing beyond portion 54 is a lower twist drill

portion 60 which, as before, includes a groove 62 with a cutting edge margin 64 and finally terminates in a pointed end 66.

Reamer portion 54 is of the straight type which often is more suitable when dealing with particularly hard materials in which a hole is to be formed. At least with some hard materials, a smoother finish can be provided with this variety of reamer as compared with a twisted reamer. Nevertheless, the straight reamer still can leave blemishes in the shaved surface. The purpose of upper twist drill portion 48 is to make a final sweep of the wall so as to remove any burrs left by the reamer, as well as to auger on out of the hole particles forced through grooves 58 by lower twist drill portion 60. In addition, when the overall length of the drill bit is rather long, an excessive length of reamer portion 54 might overly tend to allow the reamer function to become excessive to the point that the hole is unduly enlarged by action of the reamer in the event of lateral pressure against the upper end of the bit; twist drill portion 48 at the top tends to ride more smoothly within an already formed bore.

Also preferably formed into hex shank 42, above groove 43, is a circumfernetial detenting groove 68. It serves to cooperate with a special chuck in the manner described in the aforementioned co-pending application No. 271,394. Even when not used with a special chuck, groove 68 still serves as an indication of unique source or origin.

In the embodiment of Figure 7, a drill bit 70 has its upper or coupling portion 72 of hexagonal cross-section as before. Portion 72 includes a shear groove 73 and then continues into a smooth portion 74 following which is a twist reamer 76 that has a spiral groove 78 with a shaving margin 80 at one side of the groove. Continuing beyond twist reamer 76 is a pointed twist drill portion 82 that has its spiral groove 84 with a cutting-edge margin 86. Also as before, hex portion 72 preferably has an additional detenting groove 88.

The principle difference in Figure 7 from Figure 1 is that the diameter of reamer 76 is tapered outwardly in an upward direction. That is, its external diameter increases from being the same at the top of twist drill 82 to a greater dimension where it merges into portion 74. This version is intended for use where it is desired to flare the upper end of the hole being formed. That is sometimes desired for accommodating different kinds of fastening devices that are to be secured to the body in which the hole has been made.

In Figure 8, a drill bit 90 again has its coupling or upper end 92 of hexagonal cross-section. Included in portion 92 is a circumferential detenting groove 93 again for cooperation with a special chuck in the manner described in the aforementioned co-pending application No. 271,394. Portion 92 continues into a smooth portion 94 following which is a pointed twist drill portion 96 that has a spiral groove 98 with a cutting-edge margin 100.

In bit 90, hex portion 92 has a uniform cross-sectional area which is significantly larger than that of portions 94 and 96. Preferably, portion 92 is sized to be almost as large as the maximum that can be accepted by a conventional drill chuck designed to grasp any of a series of bits of different diameters up to that maximum. All bits in a set of different sizes should have the same diameters of large portion 92. Thus, even the smallest drill in the set has a large coupling portion that is more securely grasped by the chuck. This avoids the frequent problem with ordinary bits, wherein the smaller bits most frequently slip inside such a chuck.

Because hex portion 2 is larger than the drill stem of portions 94 and 96, no shear groove has been included. In case of a blockage to rotation of the stem, the bit stem will shear off without the danger posed when the stem is larger than the hex shank.

As illustrated, the twist drill portions and the reamer portions are shown as being of approximately the same length. That is not necessary. Depending upon the materials to be drilled, one portion might be considerably longer than another. In most cases, a reamer or smoothing portion need not be very long as compared with the lower twist drill portion. In other cases, as mentioned above, it may, on the other hand, be desired to shorten the relative length of the twist drill portion. In any case, it is also to be noted that

no matter what additional sections are included, the lower twist drill portion may still be used for those applications that require only that portion. Thus, the user would not need to have ordinary twist drills and, in using just the twist drill portion, it still would be exceedingly well gripped by the common form of chuck.

Features of the four different embodiments may be interchanged. In any event, overall characteristics of the approaches disclosed enable the achievement of a number of different features which include combinations of different basic devices formed on the same one-piece rod in order to provide a desired result with whatever particular material has to be drilled in a given situation and with respect to the degree of smoothness which needs to be satisfied in the wall of the hole being formed. For continuous work with one given material, only the most appropriate version would be needed. Where versitility is required in working with a variety of different materials, it would be desirable to have a collection of several different versions. In all cases, the drill bit mounts exceedingly securely in the common three-jaw chuck, although it would also mount with greater security in a two-jaw chuck and can yet be grasped by other chucks when necessary. Of course, larger drill bits would be exceedingly secure in a six-jaw chuck.

While particular embodiments of the invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects. Therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true scope of that which is patentable.

I claim:

1. A drill bit comprising:

an elongated one-piece rod composed of tool steel;

one end portion of said rod having a hexagonal cross-section;

the other end portion of said rod being pointed and shaped along its length to define a twist drill of uniform external diameter and having a spiral groove with one margin defining a cutting edge facing in a direction of rotation;

and an intermediate portion of said rod, between said end portions, formed along its length to define a reamer shaped to shave in said direction of rotation.

2. A drill bit as defined in Claim 1 in which said intermediate portion has a spiral groove one margin of which defines a shaving edge.

3. A drill bit as defined in Claim 3 in which said grooves twist in opposite directions.

4. A drill bit as defined in Claim 1 in which said intermediate portion is of a uniform external diameter the same as that of said other end portion.

5. A drill bit as defined in Claim 1 in which said intermediate portion has an external diameter the same as that of said other end portion adjacent thereto but which smoothly increases in size in the direction toward said one end portion.

6. A drill bit as defined in Claim 1 in which said intermediate portion has a plurality of longitudinal grooves spaced circumferentially therearound with one margin of each groove defining a shaving edge.

7. A drill bit as defined in Claim 1 which further includes an intervening portion, between said one end portion and said intermediate portion, shaped along its length to define a twist drill of uniform external diameter substantially the same as that of said other end portion and having a spiral groove with one margin defining a cutting edge facing in the direction of rotation.

8. A drill bit as defined in Claim 1 in which all portions of said rod, from the juncture with said one end portion to the free end of said other end portion, have said uniform external diameter.

9. A drill bit comprising:

an elongated one-piece rod composed of tool steel;

one end portion of said rod having a hexagonal cross-section;

the other end portion of said rod being pointed and shaped along its length to define a twist drill of uniform external diameter and having a spiral groove with one margin defining a cutting edge facing the direction of rotation;

an intermediate portion of said rod, between said end portions, formed along its length to follow said other end portion into a hole and shaped to smooth the wall of said hole behind said one end portion;

and all portions of said rod, from the juncture with said one end portion to the free end of said other end portion, having said uniform external diameter.

10. A drill bit comprising:

an elongated one-piece rod composed of tool steel;

one end portion of said rod having a hexagonal cross-section;

the other end portion of said rod being pointed and shaped along its length to define a twist drill of uniform external diameter and having a spiral groove with one margin defining a cutting edge facing the direction of rotation;

an intermediate portion of said rod, between said end portions, formed along its length to follow said other end portion into a hole and shaped to smooth the wall of said hole behind said one end portion;

all portions of said rod, from the juncture with said one end portion to the free end of said other end portion, having said uniform external diameter;

and said one end portion having a cross-sectional area which is significantly larger than that of said other end portion and said intermediate portion.

11. A drill bit as defined in Claim 10 in which said cross-sectional area is uniform throughout substantially the length of said one end portion.

12. A drill bit as defined in Claims 1, 9 or 10 which further includes a circumferentially-directed groove formed into said one end portion near the junction between said one end portion and the remainder of said rod, the depth of said groove being selected to enable said remainder to shear free while being driven when continued rotation of said other end portion is substantially prevented.

13. A bit comprising:

an elongated one-piece rod composed of tool steel;

one end portion of said rod having a hexagonal cross-section;

the other end portion of said rod being shaped along its length to define a hole-forming shaping tool;

an intermediate portion of said rod, between said end portions, formed along its length to follow said other end portion into a hole;

and a circumferentially-directed groove formed into said one end portion near the juncture between said one end portion and the remainder of said rod, the depth of said groove being selected to enable said remainder to shear off while being driven when continued rotation of said other end portion is substantially prevented.

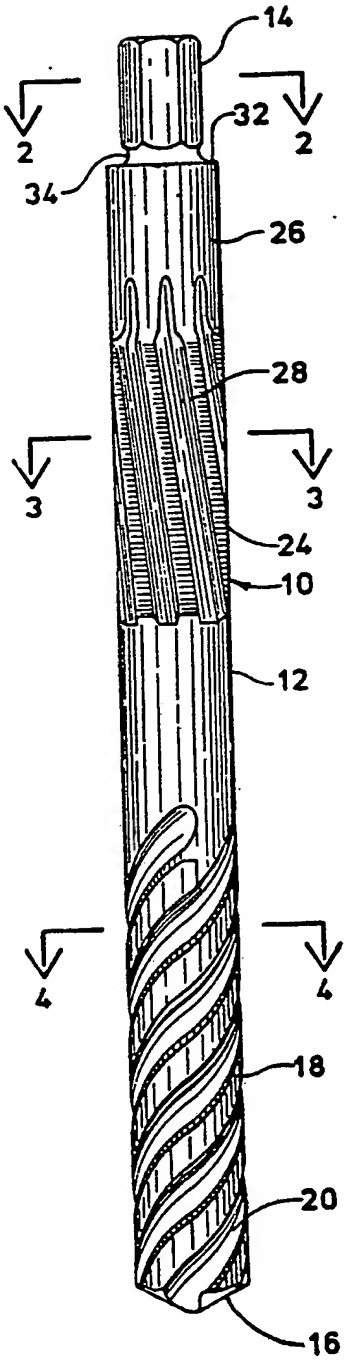

Fig. 1

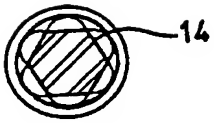

Fig. 2

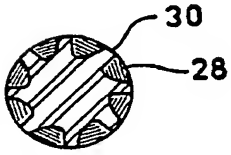

Fig. 3

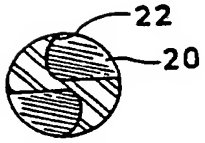

Fig. 4

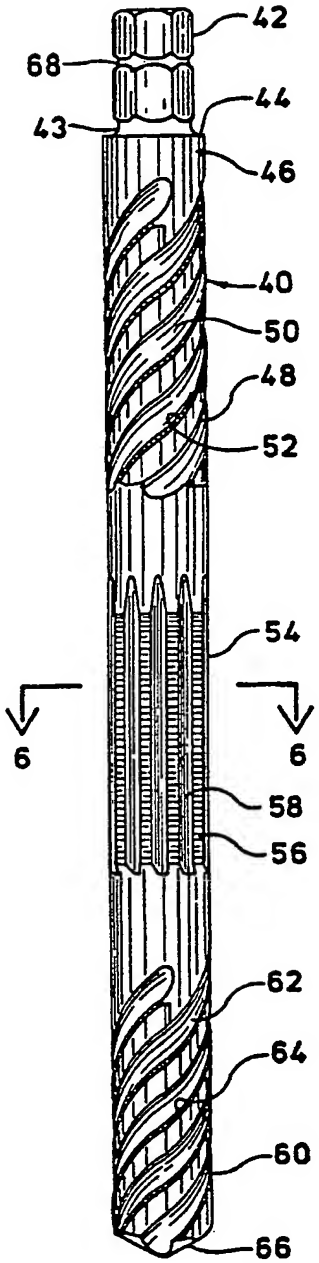

Fig. 5

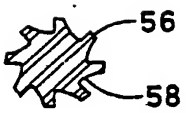

Fig. 6

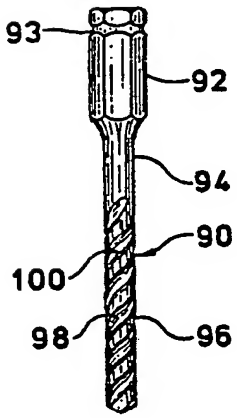

Fig. 8

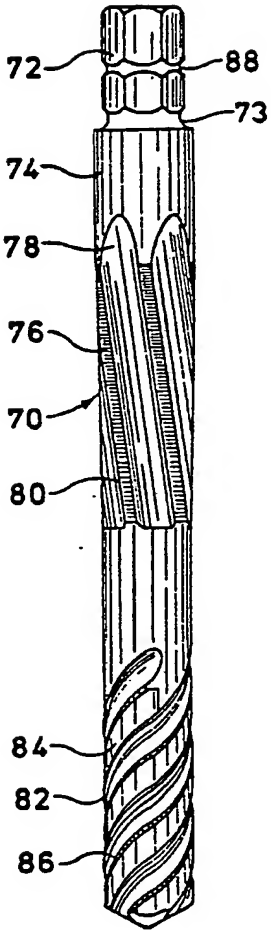

Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No PCT/US83/00299

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL.3 B23B 51/00, 51/02; B23D 77/00; B23P 23/02
U.S. CL. 408/224, 226; 29/566

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	408/224,226 29/566, 566.1

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
Y	US, A, 2,369,120, (FERRIES) 13 February 1945	1-13
Y	GB, A, 10,973, (STROVER) 20 May 1908	1-13
Y	US, A, 2,342,143, (HOWE) 22 February 1944	1-13
Y	US, A, 4,080,093, (MAIER) 21 March 1978	10-12
Y	US, A, 253,263, (BULTMANN) 7 February 1882	1-13
Y	US, A, 2,740,974, (LEWIS) 10 April 1956	12-13
Y	US, A, 3,645,642, (KOSLOW) 29 February 1972	10-12
Y	US, A, 4,135,847, (HEMMINGS) 23 January 1979	10-12
Y	US, A, 3,067,509, (WELLES, JR) 11 December 1962	6
Y	US, A, 1,355,065, (SIMPSON) 5 October 1920	1-13
Y	US, A, 2,389,909, (HOFBAUER) 27 NOVEMBER 1945	12
Y	US, A, 3,667,857, (SHANER ET AL) 6 June 1972	1-13
Y	GB, A, 20,498 (SCHROERS) 28 September 1898	1-13

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

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IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
02 June 1983	16 JUN 1983
International Searching Authority [1]	Signature of Authorized Officer [20]
ISA/US	Leonidas Vlachos LEONIDAS VLACHOS

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